

CLAIMS

What is claimed is:

1. A response device compatible with a magnetic resonance imaging
5 (MRI) apparatus and similar medical techniques associated with
strong magnetic environments, the device comprising:
 - a. A keypad connected with a fiber optic cable to an electronic
unit that includes photoelectric means for illuminating optical
10 fibers in said fiber optic cable, photo-detecting means for
detecting the light coming from said keypad through said
fiber optic cable, and signal processing means for
processing signals from said photo-detecting means, and
communication with external devices;
 - b. Fiber optic push-button switches that are located in said
15 keypad to be pressed by a patient who is undergoing a
response test, each said fiber optic switch comprising:
 - (b1) A base and an actuator that can move in said
base while being pushed at the depressing end;
 - (b2) A spring that keeps said actuator in a fixed
20 position in said base when said actuator is not
depressed;
 - (b3) An illuminating fiber that provides light to a shutter
that is attached to another end of said actuator;
 - (b4) A receiving fiber that is located in said base
25 coaxially with said illuminating fiber, said receiving and
illuminating fibers providing a gap for sliding said
shutter in it when said shutter moves in said base.
 - c. A body of said keypad represents a box with a plurality holes
30 in the front, left, and right sides for mounting of said fiber
optic push-button switches in different locations on the
keypad.

2. The response device of claim 1 wherein each said fiber optic push-button switch comprises:
- a. A base and an actuator that can move in said base while
5 being pushed at the depressing end;
 - b. A spring that keeps said actuator in a fixed position in said base when said actuator is not depressed;
 - c. An optical fiber that provides light to a reflective surface at
10 another end of said actuator and collects light that is reflected from said reflective surface.
3. The response device of claim 1 wherein:
- a. Said base of said fiber optic push-button switch has snapping means on its top surface;
 - 15 b. An internal surface of said box has snapping means that mate with said snapping means of said base;
 - c. Said fiber optic push-button switch is mounted inside of said box by mating said snapping means on said base and said internal surface;
 - 20 d. Said depressing end of said actuator is facing out from an external surface of said box at a distance from 2 mm to 20 mm;
 - e. Said depressing end of said actuator is inserted in one of said openings in said box;
 - 25 f. Said depressing end of said actuator can slide in an opening where it is inserted.
4. The response device of claim 1 wherein:
- a. Said base of said fiber optic push-button switch has
30 snapping means on its bottom surface;

- b. An internal surface of said box has snapping means that mate with said snapping means of said base;
 - c. Said fiber optic push-button switch is mounted inside of said box by mating said snapping means on said base and said internal surface;
 - d. Said depressing end of said actuator is facing out from the external surface of said box at a distance from 2 mm to 20 mm;
 - e. Said depressing end of said actuator is inserted in one of said openings in said box;
 - f. Said depressing end of said actuator can slide in an opening where it is inserted.
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9. The response device of claim 7 wherein said eight fiber optic push-button switches are located on said front side in a circular arrangement.
- 5 10. The response device of claim 7 further comprising:
- a. A knob that is inserted into said central opening;
 - b. Said knob has a flange that can touch all said depressing ends of said fiber optic push-button switches;
 - c. Said knob can be tilted and rotated inside said central opening and said flange can press said depressing ends of
- 10 said fiber optic push-button.
11. The response device of claim 10 further comprising:
- a. A handle with a start button on it;
 - b. Said start button is connected to a movable fiber optic switch
- 15 that is inside of said box and is attached to the end of said handle that is inserted into said central opening.
12. The response device of claim 10 further comprising:
- a. An elastic ring that is located under said flange;
 - b. Said ring holds said knob perpendicular to front side of said box if said knob is not tilted;
 - c. An insertion part of said knob has fixing means that prevent
- 20 said knob from being removed from said box when said knob is tilted and rotated.
- 25 13. The response device of claim 6 wherein:
- a. Said keypads are connected with peripheral fiber optic cables to a Y-box;
 - b. Said Y-box is connected to said electronic unit with a main
- 30 fiber optic cable.

14. The response device of claim 13 further comprising:

- a. A third keypad with said knob in it;
- b. Said third keypad is connected with said peripheral fiber optic cable to said Y-box.

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15. The response device of claim 14 wherein:

- a. Said main fiber optic cable has a length from 10 m to 30 m;
- b. Said peripheral fiber optic cable has a length from 0.5 m to 2.5 m.

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16. The response device of claim 1 wherein:

- a. Said electronic unit has a plurality of light sources coupled to illuminating optical fibers of said main fiber optic cable;
- b. Said electronic unit has a plurality of photo-detectors coupled to receiving optical fibers of said main fiber optic cable;
- c. Said light sources and photo-detectors are controlled by a micro-controller;
- d. Said micro-controller provides output signals that correspond to pressing events of said fiber optic push-button switches.

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17. The response device of claim 16 wherein said micro-controller provides output signals that are synchronized with external sound or visual stimuli that are provided to said patient.

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18. The response device of claim 16 wherein said micro-controller provides output signals that are synchronized with signals from the MRI scanner.

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19.The response device of claim 1 wherein said micro-controller provides an indication on a screen located on said electronic unit about which said fiber optic push-button switches are depressed at each moment.

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20.The response device of claim 1 wherein all parts, except said electronic unit, are made of non-ferrous materials.

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